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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/829,148	04/20/2004	Roger J. Malik	690-002	5092
27776 7590 07/09/2009 WARD & OLIVO SUITE 300 382 SPRINGFIELD AVENUE SUMMIT, NJ 07901				
EXAMINER				
CHEN, KEATH T				
ART UNIT		PAPER NUMBER		
1792				
MAIL DATE		DELIVERY MODE		
07/09/2009		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/829,148

Applicant(s)

MALIK, ROGER J.

Examiner

KEATH T. CHEN

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 April 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) See Continuation Sheet is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131 and 133-155 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Final Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

Continuation of Disposition of Claims: Claims pending in the application are 1-4,8-19,21-24,26-31,40-59,63-78,81-83,92-113,115-131 and 133-155.

DETAILED ACTION

Response to Amendment

1. The claim amendment filed on 04/15/2009, addressing claims 1-4, 8-19, 21-24, 26-31, 40-59, 63-78, 81-83, 92-113, 115-131, 133-135, and 144-155 rejection from the non-final office action (12/10/2008), by amending claims 19, 77-78, 101, 151, and 155 is acknowledged and will be addressed below.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the “a micrometer screw attached to a linear motion vacuum feedthrough attached to a shaft driving said piston” of claims 41, 46, 93, 98, 145, and 150 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet”

pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim interpretation

Claims 59 and 113 each recites “ceramic coating is said insulator”. This will be interpreted as “said conducting probes are insulated with ceramic coating”.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. **Claims 101-113, 115-131, 133-135, 144-152, and 154 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement and the enablement requirement.** The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 101 recites “said first probe ... and said second probe ... to maintain ... at temperatures to prevent condensation of evaporated metal”. However, the Specification describe

the liquid level probe, there is no teaching nor enablement how the liquid level probe is used to control the temperature.

3. Claims 29-31; 41-42, 46, 98, 150; 21, 56; 110, 115-118, 149; 3, 22, 30, 52, 57, 83, 106, 111, and 134 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

Claim 29 recites the "said heater elements". There is insufficient antecedent basis for this limitation in the claim because the parent claim 1 recites "at least one heater element", which includes "one heater element".

Claim 29 will be examined as "said at least one heater element".

Claims 41, 46, 98, and 150 each recites the limitation "said linear motion vacuum feedthrough attached to a shaft driving said piston". There is insufficient antecedent basis for this limitation in the claim.

Claims 41, 46, 98, and 150 will be examined as "a linear motion vacuum feedthrough attached to a shaft driving said piston".

Claims 21 and 56 recites "at least one of said conducting probes" and claims 23 and 58 recites "said conducting probes are insulated from each other" while the parent claim 1 (or 55) recites "at least one said conducting probe".

Claims 21 and 56 will be examined as "the at least one of said conducting probe comprises at least two conducting probes". Note there is no definition of the spatially relationship of the two probes, therefore, insulation can be inherent for two spaced probes.

Claim 110, 115-118, and 149 each recites "at least one conducting probe ..." However, the parent claim 101 recites "at least two conducting probe ..."

Claim 110, 115-118, and 149 will be examined as "one of the at least two conducting probes ..."

The term "reduce the required heating element power" in claims 3, 22, 30, 52, 57, 83, 106, 111, and 134 is a relative term which renders the claim indefinite. The term "reduce" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claims 3, 22, 30, 52, 57, 83, 106, 111, and 134 will be examined as long as densified graphite is used, the property of "reduces ... power" is intrinsic.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1-2, 9-17, 19, 40, 43-45, 47-51, 55, 67-76, 78, 92, 95-97, 99-100, 153, and 155 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito (JP 62-237721, hereafter '721), in view of De Lange (US 2508500, hereafter '500) and Mercer (US 5407000, hereafter '000).

'721 teaches some limitations of:

Claim 1: an MBE growth device (fig. 1) with gallium source (#13, English translation, page 6, line 10) in source cell (#12, line 13, the claimed "liquid metal evaporation source for MBE process and the evaporator") with heater (#14, line 13, capable of maintained at a first

temperature that is higher than other two temperatures), an external source reservoir (#20, line 14, the claimed “hollow reservoir cylinder maintained at a third temperature”, as Gallium melting point is slightly above room temperature, intrinsically a heater is needed to maintain the melt), a pipe (#28, line 14, the claimed “hollow transport tube”) connecting between source cell (#12) and source reservoir (#20), a liquid surface monitor (#32, line 16) by electrode (#34) on the liquid surface (the claimed “conducting probe” and “to sense contact with liquid metal in said evaporator by making a low resistance electrical contact”) that controls valve (#30) by monitor signal (page 7, lines 17-21, the claimed “measure and regulate said liquid metal height within said evaporator” and feedback control), temperature of source cell and source reservoir are maintained (the claimed two heater elements out of three), keeping liquid height and temperature constant (page 8, lines 12-16, the claimed “said conducting probe controls ... said reservoir cylinder via an automatic feedback control circuit to regulate the level of said liquid metal in said evaporator to maintain a constant evaporation rate of said liquid metal from said evaporator at a fixed evaporator temperature” except piston is not taught).

‘721 does not teach the other limitations of:

Claim 1: (a hollow reservoir cylinder) having a cylindrical piston, (a hollow transport tube) maintained at a second temperature less than said first temperature and greater than said third temperature (temperature setting is intended use), heater element for the pipe (#28) and thermocouple to sense the temperature, reservoir cylinder and said piston are configured to prevent leakage of liquid metal through the mating surfaces of said reservoir cylinder and said piston.

'500 is an analogous art in the field of metal coating (title) by evaporation (col. 1, line 3). '500 teaches a heating element (#5) for the intermediary tube (#27) to avoid solidification in the long narrow tube (Fig. 3, col. 5, lines 53-59) and a piston movable within vessel to maintain a constant level of molten metal (claim 3, col. 6, lines 51-60).

'000 is an analogous art in the field of handling molten metal (title). '000 teaches a thermocouple (#74, col. 8, lines 39-43), particular in the conduit/hollow transport tube for the purpose of temperature control (col. 15, lines 14-20). Note the molten metal source is independently controlled by using sensor #70.

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have replaced the gravity feed of molten metal in the apparatus of '721 with a piston, as taught by '500, for the purpose of maintaining a constant level of molten metal, as taught by '500 (col. 6, lines 54-60) and required by '721's apparatus. Furthermore, to have added a third heater to the intermediary tube/hollow transport tube for the purpose of avoiding solidification in the long narrow tube, as taught by '500 (col. 5, lines 53-59) and by '000 (col. 8, lines 39-43). Still furthermore, to have adopted thermocouple for maintaining temperature for each heater, as taught by '000 (col. 8, lines 39-43). Note with three independent heaters and three thermocouple, the apparatus can be operated at many temperature setting, including the first temperature higher than the second temperature which, in turn, is higher then the third temperature (an intended use of apparatus, no additional structure limitation). Note the added

piston intrinsically needs to have the claimed “are configured to prevent leakage of liquid metal through the mating surfaces of said reservoir cylinder and said piston”.

Claims 49, 50, and 55 are rejected for the substantially the same reason as claim 1 rejection above.

The piston would have been fitted with a tight tolerance to avoid leak, therefore, to have had the limitation of claim 153; and the piston is intrinsically manually set (even computer control need manual input, for claims 40 and 92).

For claims 2, 47, 51, and 99, ‘721 is silent of the material of the apparatus. ‘000 further teaches the use of ceramic refractory material in molten metal container because it is non-reactive to molten metal (col. 6, lines 23-24), therefore, it would have been obvious for a person of ordinary skill in the art to have adopted ceramic refractory material as the evaporator, hollow transport tube, the reservoir, and/or the piston. Note the “machine from” is a product-by-process claim.

‘721 further teaches the Ga liquid metal (claims 48 and 100); the reservoir, pipe, and evaporator are joined via a passageway (any portion of the zigzag pipe is considered a passageway, for claims 10, 14, 68, and 73); a cone shape orifice (the inner portion of #12 as shown in Fig. 1, the outer portion of #12 is considered evaporator, which intrinsically meet the function described in claims 155, 19, and 78).

The use of flanges to connect machine parts along with nuts, screws, bolts or clamps with accompanying seals would have been obvious to one of ordinary skill in the mechanical arts. Furthermore, to have used refractory material for such connection to avoid reaction with the liquid metal ('000, col. 6, lines 23-24), including the well-known molybdenum and graphite refractory materials.

'721 further teaches the reservoir and the pipe are connected at right angle. However, '721 is silent on the connection details of these parts. It would have been obvious for a person of ordinary skill in the art to connect reservoir and the pipe by a leak-tight flange (for claims 9, 13, 67, and 72), a screws (the claimed threaded assembly of claims 11, 16, 69, and 74), a refractory clamp (for claims 12, 15, 70, 71, 75, and 76), a molybdenum or graphite nuts and bolts (for claim 17).

'500 further teaches means to actuate said piston (the claimed "automatically adjusted" of claims 43 and 95). '721 teaches to maintain the liquid metal level, therefore, in the above combination, it would be obvious to attach the feedback control using electronic system to the means to actuate said piston (the claimed "electronic feedback control circuit" of claim 44 and 96) with signal from the liquid level monitor (#32, the claimed "electronic feedback control circuit senses the electrical contact resistance between said liquid metal and said conducting probe" of claims 45 and 97).

5. **Claims 8, 66, 77, 101-105, 107, 109, 115-116, 118-131, 144, 147-149, 151-152, and 154 are rejected under 35 U.S.C. 103(a) as being unpatentable over ‘721, ‘500, and ‘000, further in view of Colombo (US 5827371, hereafter ‘371).**

‘721, ‘500, and ‘000, together, teach all limitations of claim 1 which are applicable to Claim 101. The heater in each evaporator, hollow transport tube, and reservoir of the above combination inherently is used to prevent solidification of the liquid metal and emits IR.

‘721 further teaches the inner cone shape container of the evaporator (#12, the claimed “cone-shaped vapor orifice at said evaporator”, the outer wall is considered evaporator), and teaches one liquid surface monitor (#32) at cone-shaped vapor orifice (for the claim 77), but teaches only one liquid surface monitor.

‘721, ‘500, and ‘000, together, do not teach the other limitation of:

Claim 101: at least two conducting probes, a first disposed at said evaporator in thermal communication with said evaporator.

‘371 is an analogous art in the field of MBE effusion cell (abstract), particularly in using liquid metal (col. 3, line 9). ‘371 teaches a multi-section evaporation unit (Fig. 18, for example) with a corresponding evaporator and cone shaped orifice (see Fig. 1 and 2, for example), for the purpose of cracking (col. 3, lines 43-54).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have replaced the evaporator (#12) of '721 with the evaporator in Fig. 12, 1, and 2 of '371 that has distinct evaporator and orifice sections, for the purpose of cracking (col. 3, lines 43-54). Because the apparatus can be operated at different level of liquid height; in addition to operating liquid height in the cone shaped section as shown in '721, or in the based section/evaporator (as shown in Fig. 2 or Fig. 5 of '371), it would have been obvious for a person of ordinary skill in the art to have added a first liquid level monitor inside the based section/evaporator (claim 77) for the purpose to operate in the cracking mode (col. 3, lines 43-54) and maintain a constant level of liquid metal. The first liquid level monitor (one in the cylindrical portion of the evaporator) would have been below the liquid metal surface (especially when operated in cracking mode and/or when liquid is at a level filling the orifice as shown in '721, for claim 116).

'721 further teaches the liquid level monitor (#32, Fig. 1) with the electrode (#34) above the liquid metal (for claim 115).

The above combination intrinsically maintain evaporator at a high temperature to evaporate liquid metal (for claim 102, note "high" is a relative term); and three heaters can be used in any temperature settings (including claims 103 and 104).

For claim 8, 66, 120, '371 further teaches a single piece PBN vaporizer (see Fig. 5, col. 3, lines 27-28). It would have been obvious for a person of ordinary skill in the art to have made other parts from one piece PBN (the reservoir, for example).

Claims 105, 107, 109, 118, 121, 126, 122, 127, 123, 128, 124, 125, 129, 130, 131, 144, 147-149, 151, 152, 154 are rejected for substantially the same reason as claim 51, 53, 1, 44, 9, 13, 68, 73, 11, 16, 70, 71, 75, 76, 19, 40, 43-45, 47, 48, 153 rejection discussed above, respectively.

Claim 119 is rejected for the reason discussed above in the combination of '500 and '000 with '721 for claim 1.

6. **Claims 3, 18, and 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, and '000, further in view of David (US 4672813, hereafter '813).**

'721, '500, and '000, together, teach all limitations of claims 2, 15, and 51, as discussed above. All the heaters from prior art inherently emit IR (part limitations of claim 52).

'721, '500, and '000, together, do not teach the other limitations of:

Claims 3 and 52: refractory material is densified graphite.

Claim 18: refractory nuts and bolts made from densified graphite.

'813 is an analogous art in the field of combustion motor (title). '813 cites newer materials such as densified graphite offer advantages of high temperature resistance and low thermal expansion (col. 1, lines 50-53). It is well-known that graphite is a refractory material, as

discussed above.

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have adopted densified graphite as the refractory material for the refractory materials for evaporator, hollow transport tube, or the reservoir (for claims 3 and 52), or the piston (further for claim 3), and for the refractory nuts and bolts (for claim 18), for the purpose of providing high temperature resistance and low thermal expansion, as taught by '813.

Claim 53 is rejected for substantially the same reason as claim 2 rejection above ('000 refractory material does not react with liquid metal).

7. Claim 106 is rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, '000, and '371, further in view of '813.

'721, '500, '000, and '371, together, teach all limitations of claim 105, as discussed above.

For substantially the same reason as claim 3 rejection above, claim 106 is rejected.

8. Claims 4 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, and '000, further in view of Finicle (US 5158750, hereafter '750).

'721, '500, and '000, together, teach all limitations of claims 2 and 51, as discussed above.

'721, '500, and '000, together, do not teach the other limitations of:

Claim 4: evaporator, reservoir cylinder, transport tube, or piston is coated with pyrolytic graphite.

Claim 54: evaporator, reservoir cylinder, or transport tube is coated with pyrolytic graphite (or other materials listed).

'750 is an analogous art in the field of MBE (col. 1, line 27-28), particularly in coating metal (col. 1, line 26). '750 teaches coating of pyrolytic graphite on the external surface of crucible to alleviate cool top end of the crucible (col. 1, line 54-58) because its high thermal conductivity in plane direction (col. 3, lines 2-4).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have coated pyrolytic graphite to the external surface to any of the evaporator, reservoir, transport tube, and /or piston of the above combination apparatus for the purpose of high thermal conductivity to reduce the temperature non-uniformity, as taught by '750.

9. **Claim 108 is rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, '000, and '371, further in view of '750.**

'721, '500, '000, and '371, together, teach all limitations of claim 101, as discussed above.

For substantially the same reason as claim 4 rejection above, claim 108 is rejected.

10. **Claims 21-22 and 56-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, and '000, further in view of Bullough et al. (US 4072599, hereafter '599).**

'721, '500, and '000, together, teach all limitations of claims 1 and 55, as discussed above. '721 is silent on the electrode material.

'721, '500, and '000, together, do not teach the other limitations of:

Claims 21 and 56: conducting probes are made from a non-reacting refractory material.

Claims 22 and 57: said refractory material is densified graphite.

'599 is an analogous art in the field of metallurgical industry (liquid metal, Field of the invention), particularly in metallurgical grade electrode. '599 teaches preparation of densified graphite electrode suitable for metallurgical grade electrode (col. 1, line 40 to col. 2, line 33, especially line 29).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have adopted densified graphite as the electrode material in the above combined apparatus for its suitability use in liquid metal, as taught by '599. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

11. Claim 110 and 111 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, '000, and '371, further in view of '599.

'721, '500, '000, and '371, together, teach all limitations of claim 109, as discussed above.

For substantially the same reason as claims 21-22 rejection above, claims 110-111 are rejected.

12. Claims 23-24, 26-27, 58-59, and 112-113 are rejected under 35 U.S.C. 103(a) as being unpatentable over ‘721, ‘500, ‘000, and ‘599, further in view of ‘371 and Bahney (US 2195071, hereafter ‘071).

‘721, ‘500, ‘000, and ‘599, together, teach all limitations of claims 22 and 57, as discussed above.

‘371 is an analogous art as discussed in claims 8, 101, etc rejection above which discussed two conducting probes, one in the evaporator and another in the cone-shaped orifice.

‘721, ‘500, ‘000, ‘599, and ‘371, together, teach all limitations of claim 111, as discussed above.

‘721, ‘500, ‘000, ‘599, and ‘371, together, do not teach the other limitations of:
Claims 23, 58, and 111: said conducting probes are insulated from each other and insulated from the walls of the evaporator.

Claim 24: non-conductive ceramic coating.

Claims 59 and 113: ceramic coating is said insulator.

‘071 is an analogous art in the field of molten metal (title), particularly with the level of melt (page 1, left, line 26). ‘071 teaches a suitable contacting means (the claimed probe) with

wires surrounded by a protective tube of porcelain or the like (page 4, right, lines 62-end), to avoid contact be made if spatter occurs. Note '071 also teaches the use of graphite as electrode material (page 5, left, lines 11-13), consistent with '599 teaching of using densified graphite for metallurgical grade electrode.

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have applied porcelain protective tube (porcelain is a ceramic) the each monitor/probe in the vaporizer and in the cone-shaped orifice as taught by '071, to the combined apparatus of '721, '500, '000, '599 and '371, for the purpose of avoiding contact be made if spatter occurs. Therefore, the probes would have been insulated from each other and from the wall of the evaporator.

Note that the second probe in the cone-shape orifice is being described as insulated from the wall of the evaporator in claims 23 and 58. While this description is met technically, Applicant may consider amending the second probe as being insulated from the wall of the cone-shaped vapor orifice, if no new matter is introduced.

Claims 26 and 27 are rejected for substantially the same reason as claims 115 and 116 rejection above.

13. Claims 63-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, and '000, further in view of Ueno (US 6279330, hereafter '330).

'721, '500, and '000, together, teach all limitations of claim 55, as discussed above. '721 teaches the electrode (#34) of the monitor (#32) from top opening of the cone-shaped evaporator.

'721, '500, and '000, together, do not teach the limitations of:

Claims 63; at least one of said conducting probes makes a first contact with said liquid metal on its surface and makes a second contact with said liquid metal through conductive walls of said evaporator.

'330 is an analogous art in the field of monitor liquid level sensor (col. 8, lines 45-53).
'330 teaches sensors (#22 and #23, Fig. 1, upper right) installed on the side wall.

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have re-arranged the electrode/probe from the top opening of the evaporator to through the side wall of the evaporator wall, especially knowing the electrode would have interfered with the uniformity of the vapor from the evaporator nozzle.

'721, '500, and '000, together, disclose the claimed invention except for direction of the electrode connected to the evaporator. It would have been an obvious matter to re-arrange the electrode connection to the evaporator, since it has been held that rearranging parts of an invention only involves routine skill in the art. MPEP 2144.04 VI C.

Claims 64-65 are rejected for substantially the same reason as claims 43-44 rejection above.

14. **Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, '000, and '599, further in view of '330.**

'721, '500, '000, and '599, together, teach all limitations of claim 22, as discussed above.

For substantially the same reason as discussed in claim 63 rejection above, claim 28 is rejected.

15. **Claim 117 is rejected under 35 U.S.C. 103(a) as being unpatentable over ‘721, ‘500, ‘000, ‘599, and ‘371, further in view of ‘330.**

‘721, ‘500, ‘000, ‘599, and ‘371, together, teach all limitations of claim 109, as discussed above.

For substantially the same reason as discussed in claim 63 rejection above, claim 117 is rejected.

16. **Claims 29-31 and 81-83 are rejected under 35 U.S.C. 103(a) as being unpatentable over ‘721, ‘500, and ‘000, further in view of Leycuras (US 20040238526, hereafter ‘526).**

‘721, ‘500, and ‘000, together, teach all limitations of claims 1 and 49, as discussed above. ‘721 is silent on the heater material and configuration.

‘721, ‘500, and ‘000, together, do not teach the limitations of:

Claims 29 and 81: said heater elements are (or at least one of said heater elements is) made from refractory materials.

Claims 30 and 83: heater element(s) is/are densified graphite.

Claims 31 and 82: said heater element(s) is/are configured in a serpentine or spiral fashion.

'526 is an analogous art in the field of high temperature heating device (abstract) and graphite resistance furnace (title). '526 teaches refractory densified graphite ([0056]) heater (Fig. 1) in with strip (#2) connected in succession via their ends (the claimed serpentine fashion) for the purpose of maximum Joule effect ([0017]).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have incorporated the heater of '526 in the combined apparatus of '721, '500, and '000, for the purpose of maximum Joule effect ([0017]).

17. Claims 133-135 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, '000, '599, and '371, further in view of '330.

'721, '500, '000, and '371, together, teach all limitations of claim 101, as discussed above.

For substantially the same reason as discussed in claims 29-31 rejection above, claims 133-135 are rejected.

18. Claims 41-42, 46, 93-94, and 98 are rejected under 35 U.S.C. 103(a) as being unpatentable over '721, '500, and '000, further in view of Natelson (US 3687632, hereafter '632) and Bacchi et al. (US 20030055533, hereafter '533).

'721, '500, and '000, together, teach all limitations of claims 40, 45, 92, and 97, as discussed above. '721 teaches feedback control as discussed above and obvious to use electronic system to control, as discussed claim 44 rejection above. '500 is silent on the details of piston.

'721, '500, and '000, together, do not teach the limitations of:

Claims 41 and 93: said position is set using a micrometer screw attached to said linear motion vacuum feedthrough attached to a shaft driving said piston.

Claims 42 and 94: the position is set using a motor to drive said micrometer screw.

Claim 46 and 98: said electronic feedback control circuit applies power to a motor that drives a micrometer screw attached to said linear motion vacuum feedthrough attached to a shaft driving said piston.

'632 is an analogous art in the field of transferring liquids between containers (title). '632 teaches micrometer screw arrangement (#412-416, Fig. 4, col. 9, lines 64-66) attached to a piston and rod (#401 and #410, col. 9, line 34 and 42, the claimed shaft) with a cam (#404) driven by motor (col. 9, lines 57-58) to move piston (#401) up and down (the claimed linear motion) for a high accuracy delivery of liquid (col. 9, lines 51-53).

'533 is an analogous art in the field of transferring semiconductor wafer (abstract), particularly in vacuum pressure activated piston ([0012]). '533 teaches an actuation mechanism ([0078]) with a vacuum feedthrough ((#162, Figs. 12-13, [0078]) for piston (#152) and motors ([0130], for example).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have incorporated the micrometer screw arrangement as taught by '632 in the combined apparatus of '721, '500, and '000, for the purpose of high accuracy delivery (col. 9, lines 51-53). Furthermore, to have adopted the vacuum actuation mechanism, as taught by '533,

for suitability for the function of actuation the piston. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. MPEP 2144.07.

19. Claims 145-146 and 150 are rejected under 35 U.S.C. 103(a) as being unpatentable over ‘721, ‘500, ‘000, ‘599, and ‘371, further in view of ‘632 and ‘533.

‘721, ‘500, ‘000, and ‘371, together, teach all limitations of claims 144 and 149, as discussed above.

For substantially the same reason as discussed in claims 41-42 and 46 rejection above, claims 145-146 and 150 are rejected.

Response to Arguments

Applicant's arguments filed 04/15/2009 have been fully considered but they are not persuasive. However, the new examiner found some detail limitations not completely addressed in the previous action, as well as some 35 USC 112 issues. For these reasons, this action is made non-final.

20. In regarding to claim 1 rejection, Applicant argues that Saito ‘721 failed to teaches “an evaporator”, “a hollow reservoir”, and “a hollow transport tube”, see the last complete paragraph of page 28, because ‘721 teaches an external reservoir, uses gravity feed, and it is not possible to weld or braze a connection the stainless steel flange, see the bottom of page 28 to the top of page 30.

These arguments are found not persuasive.

The external gravity feed reservoir read into the claim limitation “a hollow reservoir”. There is no description in ‘721 of using stainless steel as the transport tube (#28). Furthermore, ‘000 teaches the use of refractory material to handle liquid metal.

21. Applicant further argues that ‘721 failed to teaches a “a hollow reservoir cylinder having a cylindrical piston”, see the bottom paragraph of page 30; and De Lange ‘500 fails to teach a heating element on the evaporator and the use of three separate temperature zones and teaches away from heating the evaporator, see the last complete paragraph of page 32.

These arguments are found not persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The rejection is based on the combination of ‘721, ‘500, and ‘000. ‘721 teaches heaters in the evaporator and heater to maintain liquid Ga. ‘500 teaches the piston and solving the problem of solidification in pipe by adding a heater. A person of ordinary skill in the art would have been able to adopted a piston and add a heater to the pipe/transport tube.

Further, claim 1 limitation does not require three heaters, only one heater that is able to heat evaporator, reservoir, and transport tube (see the paragraph “at least one heater element ...” of claim 1). The above discussion is really addressing the limitations of claims 49 and 101.

‘500 does not criticize, discredit, or otherwise discourage the solution claimed (see MPEP 2123 II), therefore, ‘500 does not “teaching away”.

22. Applicant further argues that none of the reference teaches the three separate temperature zones have a different temperature, see the bottom paragraph of page 33.

This argument is found not persuasive.

The temperature setting is an intended use of the apparatus. As long as there are three temperature zones (as discussed above), various temperature settings can be operated by the operator as desired.

23. Applicant complains that Chow 5,031,229 teaches a heating element of pyrolytic graphite, does not teach the "one of the ... coated with a layer of pyrolytic graphite" on the external surface of claim 4, see the bridging paragraph of page 36 to 37.

Applicant is advised that claim 4 does not require a pyrolytic graphite layer on the external surface nor excluding a heater element. However, a new reference 5158750 is applied that teaches the commonly known technology of using pyrolytic graphite external coating for high thermal conductivities in plane direction.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEATH T. CHEN whose telephone number is (571)270-1870. The examiner can normally be reached on 6:30AM-3 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/K. T. C./
Examiner, Art Unit 1792

/Ram N Kackar/

Primary Examiner, Art Unit 1792